Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

Cancel claims 1-23.

24. (New): A method of determining a quantity of an electrochemically convertible substance in a gas sample, the method comprising:

introducing the gas sample into an electrochemical sensor wherein at least a portion of the gas sample is electrochemically converted to produce an electrical output;

measuring the electrical output of the electrochemical sensor on a periodic basis to produce sensor measurements;

calculating a reaction factor, a discharge factor, and an amplitude factor associated with the electrical output of the electrochemical sensor based on the sensor measurements; and

calculating the quantity of the electrochemically convertible substance in the gas sample using an arithmetic equation based on the reaction factor, the discharge factor and the amplitude factor.

25. (New): The method of claim 24 wherein operation of calculating the quantity of the electrochemically convertible substance comprises:

calculating the arithmetic equation of a form $quantity = k \bullet \left(\frac{1}{a} - \frac{1}{b} \right)$, wherein *quantity* represents the quantity of the electrochemically convertible substance in the gas sample, k represents the amplitude factor, a represents the discharge factor, and b represents the reaction factor.

26. (New): The method of claim 24 wherein the operation of calculating a reaction factor, a discharge factor, and an amplitude factor comprises:

calculating the discharge factor from an equation of a form $a = -\dfrac{\ln\left[\left(\dfrac{y_{2t}}{y_t} + \sqrt{\left|2 \bullet \dfrac{y_{4t}}{y_{2t}} - \left(\dfrac{y_{2t}}{y_t}\right)^2\right|}\right) \Big/ 2\right]}{t}$, wherein y_t is a sensor measurement at time t, y_{2t} is a sensor measurement at time $2t$, and y_{4t} is a sensor measurement at time $4t$.

27. (New): The method of claim 24 wherein the operation of calculating a reaction factor, a discharge factor, and an amplitude factor comprises:

calculating the reaction factor from an equation of a form $b = -\dfrac{\ln\left[\left(\dfrac{y_{2t}}{y_t} - \sqrt{\left|2 \bullet \dfrac{y_{4t}}{y_{2t}} - \left(\dfrac{y_{2t}}{y_t}\right)^2\right|}\right) \Big/ 2\right]}{t}$, wherein y_t is a sensor measurement at time t, y_{2t} is a sensor measurement at time $2t$, and y_{4t} is a sensor measurement at time $4t$.

28. (New): The method of claim 24 wherein the operation of calculating a reaction factor, a discharge factor, and an amplitude factor comprises:

calculating the amplitude factor from an equation of a form $k = -\dfrac{y_t}{\sqrt{\left|2 \bullet \dfrac{y_{4t}}{y_{2t}} - \left(\dfrac{y_{2t}}{y_t}\right)^2\right|}}$,

wherein y_t is a sensor measurement at time t, y_{2t} is a sensor measurement at time $2t$, and y_{4t} is a sensor measurement at time $4t$.

29. (New): The method of claim 24 wherein the electrochemically convertible substance is ethanol.

30. (New): The method of claim 24 wherein the operation of calculating a reaction factor, a discharge factor, and an amplitude factor is performed using measurements of the electrical output of the electrochemical sensor at time t, time 2t, and time 4t.

31. (New): A method of identifying an electrochemically convertible substance existing in a gas sample, the method comprising:

introducing the gas sample into an electrochemical sensor wherein at least a portion of the gas sample is electrochemically converted to produce an electrical output;

measuring the electrical output of the electrochemical sensor on a periodic basis to produce sensor measurements;

calculating a reaction factor and a discharge factor associated with the electrical output of the electrochemical sensor based on the sensor measurements;

comparing a combination of the reaction and discharge factors to a combination of predetermined reaction and discharge factors associated with one or more predetermined reactants; and

identifying the electrochemically convertible substance as one of the one or more predetermined reactants existing in the gas sample.

32. (New): The method of claim 31 wherein the operation of calculating a reaction factor and a discharge factor comprises:

calculating the discharge factor from an equation of a form

$$a = -\frac{\ln\left[\left(\frac{y_{2t}}{y_t} + \sqrt{\left|2 \bullet \frac{y_{4t}}{y_{2t}} - \left(\frac{y_{2t}}{y_t}\right)^2\right|}\right)\Big/ 2\right]}{t}$$

, wherein y_t is a sensor measurement at time t, y_{2t} is a sensor measurement at time $2t$, and y_{4t} is a sensor measurement at time $4t$.

33. (New): The method of claim 31 wherein the operation of calculating a reaction factor and a discharge factor comprises:

calculating the reaction factor from an equation of a form

$$b = -\frac{\ln\left[\left(\frac{y_{2t}}{y_t} - \sqrt{\left|2 \bullet \frac{y_{4t}}{y_{2t}} - \left(\frac{y_{2t}}{y_t}\right)^2\right|}\right)\Big/2\right]}{t}$$

, wherein y_t is a sensor measurement at time t, y_{2t} is a sensor measurement at time $2t$, and y_{4t} is a sensor measurement at time $4t$.

34. (New): The method of claim 31 wherein the electrochemically convertible substance is an alcohol.

35. (New): The method of claim 31 wherein the operation of calculating a reaction factor and a discharge factor is performed using measurements of the electrical output of the electrochemical sensor at time t, time 2t, and time 4t.

36. (New): The method of claim 31 wherein the comparing operation comprises:

comparing the reaction factor to the predetermined reaction factor associated with a predetermined reactant; and

comparing the discharge factor to the predetermined discharge factor associated with a predetermined reactant.

37. (New): The method of claim 31 wherein the identifying operation comprises:

identifying the electrochemically convertible substance as one of the one or more predetermined reactants existing in the gas sample, if the reaction factor matches the predetermined reaction factor associated with the one predetermined reactant relative to a predetermined reaction factor deviation and the discharge factor matches the predetermined

discharge factor associated with the one predetermined reactant relative to a predetermined discharge factor deviation.

38. (New): A system comprising:

an electrochemical sensor to electrochemically convert at least a portion of a gas sample to produce an electrical output;

a microprocessor programmed to measure the electrical output of the electrochemical sensor on a periodic basis to produce sensor measurements, calculate a reaction factor, a discharge factor, and an amplitude factor associated with the electrical output of the electrochemical sensor based on the sensor measurements, and calculate the quantity of the electrochemically convertible substance in the gas sample using an arithmetic equation based on the reaction factor, the discharge factor and the amplitude factor; and

a display to display results.

39. (New): The system of claim 38 wherein the microprocessor is programmed to calculate the quantity of the electrochemically convertible substance by:

calculating the arithmetic equation of a form $quantity = k \bullet \left(\frac{1}{a} - \frac{1}{b}\right)$, wherein *quantity* represents the quantity of the electrochemically convertible substance in the gas sample, k represents the amplitude factor, a represents the discharge factor, and b represents the reaction factor.

40. (New): The system of claim 38 wherein the microprocessor is programmed to calculate a reaction factor, a discharge factor, and an amplitude factor by:

calculating the discharge factor from an equation of a form

$$a = -\frac{\ln\left[\left(\frac{y_{2t}}{y_t} + \sqrt{\left|2 \bullet \frac{y_{4t}}{y_{2t}} - \left(\frac{y_{2t}}{y_t}\right)^2\right|}\right) \Big/ 2\right]}{t}$$

, wherein y_t is a sensor measurement at time t, y_{2t} is a sensor measurement at time $2t$, and y_{4t} is a sensor measurement at time $4t$.

41. (New): The system of claim 38 wherein the microprocessor is programmed to calculate a reaction factor, a discharge factor, and an amplitude factor by:

calculating the reaction factor from an equation of a form $b = -\dfrac{\ln\left[\left(\dfrac{y_{2t}}{y_t} - \sqrt{\left|2 \bullet \dfrac{y_{4t}}{y_{2t}} - \left(\dfrac{y_{2t}}{y_t}\right)^2\right|}\right) \Big/ 2\right]}{t}$, wherein y_t is a sensor measurement at time t, y_{2t} is a sensor measurement at time $2t$, and y_{4t} is a sensor measurement at time $4t$.

42. (New): The system of claim 38 wherein the microprocessor is programmed to calculate a reaction factor, a discharge factor, and an amplitude factor by:

calculating the amplitude factor from an equation of a form $k = -\dfrac{y_t}{\sqrt{\left|2 \bullet \dfrac{y_{4t}}{y_{2t}} - \left(\dfrac{y_{2t}}{y_t}\right)^2\right|}}$, wherein y_t is a sensor measurement at time t, y_{2t} is a sensor measurement at time $2t$, and y_{4t} is a sensor measurement at time $4t$.

43. (New): The system of claim 38 wherein the electrochemically convertible substance is ethanol.

44. (New): The system of claim 38 wherein the microprocessor is programmed to calculate a reaction factor, a discharge factor, and an amplitude factor using measurements of the electrical output of the electrochemical sensor at time t, time 2t, and time 4t.

45. (New): A system comprising:

an electrochemical sensor to electrochemically convert at least a portion of a gas sample to produce an electrical output;

a microprocessor programmed to measure the electrical output of the electrochemical sensor on a periodic basis to produce sensor measurements, calculate a reaction factor and a discharge factor associated with the electrical output of the electrochemical sensor based on the sensor measurements, compare a combination of the reaction and discharge factors to a combination of predetermined reaction and discharge factors associated with one or more predetermined reactants, and identify the electrochemically convertible substance as one of the one or more predetermined reactants existing in the gas sample; and

a display to display results.

46. (New): The system of claim 45 wherein the microprocessor is programmed to calculate a reaction factor and a discharge factor by:

calculating the discharge factor from an equation of a form

$$a = -\frac{\ln\left[\left(\frac{y_{2t}}{y_t} + \sqrt{\left|2 \bullet \frac{y_{4t}}{y_{2t}} - \left(\frac{y_{2t}}{y_t}\right)^2\right|}\right)\Big/ 2\right]}{t}$$

, wherein y_t is a sensor measurement at time t, y_{2t} is a sensor measurement at time $2t$, and y_{4t} is a sensor measurement at time $4t$.

47. (New): The system of claim 45 wherein the microprocessor is programmed to calculate a reaction factor and a discharge factor by:

calculating the reaction factor from an equation of a form

$$b = -\frac{\ln\left[\left(\frac{y_{2t}}{y_t} - \sqrt{\left|2 \bullet \frac{y_{4t}}{y_{2t}} - \left(\frac{y_{2t}}{y_t}\right)^2\right|}\right)\Big/ 2\right]}{t}$$

, wherein y_t is a sensor measurement at time t, y_{2t} is a sensor measurement at time $2t$, and y_{4t} is a sensor measurement at time $4t$.

48. (New): The system of claim 45 wherein the electrochemically convertible substance is an alcohol.

49. (New): The system of claim 45 wherein the microprocessor is programmed to calculate a reaction factor and a discharge factor using measurements of the electrical output of the electrochemical sensor at time t, time 2t, and time 4t.

50. (New): The system of claim 45 wherein the microprocessor is programmed to:

compare the reaction factor to the predetermined reaction factor associated with a predetermined reactant; and

compare the discharge factor to the predetermined discharge factor associated with a predetermined reactant.

51. (New): The system of claim 45 wherein the microprocessor is programmed to identify the electrochemically convertible substance as one of the one or more predetermined reactants existing in the gas sample, if the reaction factor matches the predetermined reaction factor associated with the one predetermined reactant relative to a predetermined reaction factor deviation and the discharge factor matches the predetermined discharge factor associated with the one predetermined reactant relative to a predetermined discharge factor deviation.